

What is claimed is:

1. A system for forming a patch in a well at a location along a downhole tubular string which has lost sealing integrity, comprising:

5 a tubular patch for positioning within the downhole tubular string at the location which has lost sealing integrity, the tubular patch being supported on a running tool suspended in the well from a work string;

the tubular patch including a central patch body having a generally cylindrical central interior surface, an upper expander body having a generally cylindrical upper interior surface and at least one upper exterior seal, and at least one lower  
10 expander body having a generally cylindrical lower interior surface and a lower exterior seal; and

the running tool including an inner mandrel axially moveable relative to the central patch body, one or more pistons each axially moveable relative to the inner mandrel in response to fluid pressure within the running tool, a top expander axially  
15 moveable downward relative to the upper expander body in response to axial movement of the one or more pistons for radially expanding the upper expander body into sealing engagement with the downhole tubular string, and a bottom expander axially moveable upward relative to the lower expander body in response to axial movement of the one or more pistons for radially expanding the upper  
20 expander body into sealing engagement with the downhole tubular string.

2. The system as defined in Claim 1, wherein the one or more pistons includes a first plurality of pistons for moving the top expander relative to the upper expander body, and a second plurality of pistons move the lower expander relative to the lower expander body.

5 3. The system as defined in Claim 1, wherein the upper expander body patch further includes an upper set of slips for gripping engagement with an inner surface of the tubular string, and the lower expander body includes a lower set of slips for gripping engagement with the tubular string.

4. The system as defined in Claim 1, wherein the lower expander  
10 includes a first plurality of expander segments and a second plurality of expander segments, each of the second plurality of expander segments being spaced between adjacent first expander segments and axially moveable relative to the first expander segments, such that when the first and second plurality of expander segments are vertically aligned, the first and second expander segments together  
15 expand to the lower expander body, and when the first plurality of expander segments are axially spaced from the second plurality of expander segments, the running tool may be retrieved to the surface through the central patch body.

5. The system as defined in Claim 4, further comprising:

an outer sleeve interconnecting the first plurality of pistons and the top expander; and

a shear member for interconnecting the outer sleeve and the work string.

6. The system as defined in Claim 5, further comprising:

5 an upper shear member for disconnecting the first plurality of pistons and the top expander after a selected axial movement of the top expander relative to the upper expander body.

7. The system as defined in Claim 1, wherein each of the upper exterior seal and the lower exterior seal include axially spaced seal bodies formed from  
10 graphite base material.

8. The system as defined in Claim 1, wherein the top expander is substantially in engagement with an upper end of the upper expander body and the lower expander is substantially in engagement with a lower end of the lower expander body when the tubular patch is run in the well within the tubular string.

15 9. The system as defined in Claim 1, further comprising:

a plug seat positioned within the running tool, such that a plug landed on the plug seat causes an increase in the fluid pressure in the running tool and to the one or more pistons.

10. The system as defined in Claim 1, further comprising:
- 5 a sealed expansion joint between the upper expander body and the lower expander body for thermal expansion of the central patch body.

11. The system as defined in Claim 10, further comprising:
- a plurality of circumferentially spaced dogs each radially engaged to prevent downward movement of the upper expander body in response to the top expander
- 10 and upward movement of the lower expander body in response to the bottom expander, and radially disengaged for retrieval from the upper expander body in response to axial movement of the inner mandrel.

12. The system as defined in Claim 11, further comprising:
- a plurality of biasing members for biasing each of the plurality of dogs radially
- 15 outward.

13. A system for forming a patch in a well at a location along a downhole tubular string which has lost sealing integrity, comprising:

a tubular patch for positioning within the downhole tubular string at the location which has lost sealing integrity, the tubular patch being supported on a running tool suspended in the well from a work string;

the tubular patch including a central patch body having a generally cylindrical  
5 central interior surface, an upper expander body having a generally cylindrical upper interior surface and at least one upper exterior seal, and a lower expander body having a generally cylindrical lower interior surface and at least one lower exterior seal; and

the running tool including an inner mandrel axially moveable relative to the  
10 central patch body, one or more pistons axially moveable relative to the inner mandrel in response to fluid pressure within the running tool, a top expander axially moveable downward relative to the upper expander body in response to axial movement of the one or more first pistons for radially expanding the upper expander body into sealing engagement with the downhole tubular string, a bottom expander  
15 axially moveable upward relative to the lower expander body in response to axial movement of the one or more second pistons for radially expanding the upper expander body into sealing engagement with the downhole tubular string, and a plurality of circumferentially spaced dogs each radially engaged to prevent downward movement of the upper expander body in response to the upper  
20 expander and upward movement of the lower expander body in response to the

lower expander and radially disengaged for retrieval from the upper expander body in response to axial movement of the inner mandrel.

14. The system as defined in Claim 13, further comprising:  
a plurality of biasing members for biasing each of the plurality of dogs radially  
5 outward.

15. The system as defined in Claim 13, wherein the upper expander body patch further includes an upper set of slips for gripping engagement with an inner surface of the tubular string, and the lower expander body includes a lower set of slips for gripping engagement with the tubular string.

10 16. The system as defined in Claim 13, wherein the lower expander includes a first plurality of expander segments, and a second plurality of expander segments, each of the second plurality of expander segments being spaced between adjacent first expander segments and axially moveable relative to the first  
15 expander segments, such that when the first and second plurality of expander segments are vertically aligned, the first and second expander segments together expand to the lower expander body, and when the first expander segments are axially spaced from the second expander segments, the running tool may be retrieved to the surface through the central patch body.

17. The system as defined in Claim 13, further comprising:  
an outer sleeve interconnecting the one or more first pistons and the top expander; and  
a shear member for interconnecting the outer sleeve and the work string.

5 18. The system as defined in Claim 17, further comprising:  
an upper shear member for disconnecting the one or more first pistons and the top expander after a selected axial movement of the top expander relative to the upper expander body.

19. The system as defined in Claim 13, further comprising:  
10 a sealed expansion joint between the upper expander body and the lower expander body for thermal expansion of the central patch body.

20. The system as defined in Claim 13, further comprising:  
a plug seat positioned within the running tool, such that a plug landed on the plug seat causes an increase in fluid pressure in the running tool and to the one or  
15 more first pistons and the one or more second pistons.

21. A method of forming a patch in a well at a location along a downhole tubular string which has lost sealing integrity, comprising:

positioning a tubular patch within the downhole tubular string at the location which has lost sealing integrity, the tubular patch being supported on a running tool  
5 suspended in the well from a work string;

providing the tubular patch with a central patch body having a generally cylindrical central interior surface, an upper expander body having a generally cylindrical upper interior surface and at least one upper exterior seal, and a lower expander body having a generally cylindrical lower interior surface and at least one  
10 lower exterior seal; and

providing the running tool including an inner mandrel axially moveable relative to the central patch body, one or more pistons axially moveable relative to the inner mandrel in response to fluid pressure within the running tool, a top expander axially moveable downward relative to the upper expander body in  
15 response to axial movement of the one or more pistons for radially expanding the upper expander body into sealing engagement with the downhole tubular string, and a bottom expander axially moveable upward relative to the lower expander body in response to axial movement of the one or more pistons for radially expanding the upper expander body into sealing engagement with the downhole tubular string;

20 increasing fluid pressure within the running tool to move the one or more pistons which in turn moves the top expander and the bottom expander to expand



the upper expander body and the lower expander body into sealing engagement with the tubular string; and

thereafter withdrawing the running tool from the tubular patch supported on the tubular string.

- 5           22.    The method as defined in Claim 21, further comprising:  
              providing an upper set of slips on the upper expander body for gripping  
              engagement with an inner surface of the tubular string, and  
              providing a lower set of slips on the lower expander body for gripping  
              engagement with the tubular string.

- 10           23.    The method as defined in Claim 21, wherein the lower expander is  
              provided with a first plurality of expander segments and a second plurality of  
              expander segments, each of the second plurality of expander segments being  
              spaced between adjacent first expander segments and axially moveable relative to  
              the first expander segments, such that when the first and second plurality of  
15           expander segments are vertically aligned, the first and second expander segments  
              together expand the lower expander body, and when the first expander segments  
              are axially spaced from the second expander segments, the running tool may be  
              retrieved to the surface through the central patch body.

24. The method as defined in Claim 21, further comprising:  
interconnecting with the one or more pistons and the top expander with an  
outer sleeve; and  
interconnecting the outer sleeve and the work string with a shear member;  
5 and  
increasing fluid pressure to shear the shear member.

25. The method as defined in Claim 24, further comprising:  
disconnecting the one or more pistons and the top expander after a selected  
axial movement of the top expander relative to the upper expander body.

10 26. The method as defined in Claim 21, wherein the top expander is  
substantially in engagement with an upper end of the upper expander body and the  
lower expander is substantially in engagement with a lower end of the lower  
expander body when the tubular patch is run in the well within the tubular string.

27. The method as defined in Claim 21, further comprising:  
15 providing an expansion joint between the upper expander body and the lower  
expander body for thermal expansion of the central patch body.

28. The method as defined in Claim 21, further comprising:

positioning a plug seat within the running tool, such that a plug landed on the plug seat causes an increase in fluid pressure in the running tool and to the one or more pistons.

5 29. The method as defined in Claim 21, further comprising:

providing a plurality of circumferentially spaced dogs each radially engaged to prevent downward movement of the upper expander body in response to the upper expander and upward movement of the lower expander body in response to the lower expander, and radially disengaged for retrieval from the upper expander  
10 body in response to axial movement of the inner mandrel.

30. The method as defined in Claim 29, further comprising:

biasing each of the plurality of dogs radially outward.

31. A tool for suspending in a well on a work string to radially expand a downhole tubular, comprising:

15 a housing securable downhole within the well on a lower end of the work string;

a mandrel axially moveable relative to the housing;

one or more pistons each axially moveable relative to the mandrel in response to fluid pressure within the mandrel;

a lower expander axially moveable upward relative to the downhole tubular in response to axial movement of the one or more pistons for radially expanding the  
5 downhole tubular; and

the lower expander including a first plurality of expander segments and a second plurality of expander segments, each of the second plurality of expander segments being spaced between adjacent first expander segments and axially moveable relative to the first plurality of expander segments, such that when the first  
10 and second plurality of expander segments are vertically aligned, the first and second expander segments together expand the downhole tubular, and when the first plurality of expander segments are axially spaced from the second plurality of expander segments, the tool may be retrieved to the surface through a portion of the outer tubular which was not expanded.

15 32. The tool as defined in Claim 31, further comprising:

an outer sleeve interconnecting the one or more pistons and the lower expander; and

a shear member for interconnecting the outer sleeve and the work string.

33. The tool as defined in Claim 31, where the one or more pistons include a first plurality of pistons for moving the lower expander relative to the downhole tubular.

34. The tool as defined in Claim 31, further comprising:  
5 a plug seat positioned within the running tool, such that a plug landed on the plug seat causes an increase in fluid pressure in the running tool and to the one or more pistons.

35. A method of expanding a downhole tubular, comprising:  
securing a tool housing within a well;  
10 supporting a mandrel axially moveable within the tool housing;  
providing one or more pistons axially moveable relative to the mandrel in response to fluid pressure within the mandrel;  
axially moving a lower expander relative to a downhole tubular in response to axial movement of the one or more pistons for radially expanding the outer  
15 tubular; and  
providing the lower expander with a first plurality of expander segments and a second plurality of expander segments, each of the second plurality of expander segments being spaced between adjacent first expander segments and axially moveable relative to the first plurality of expander segments, such that when the first

and second plurality of expander segments are vertically aligned, the first and second expander segments together expand the outer tubular, and when the first expander segments are axially spaced from the second expander segments, the tool may be retrieved to the surface through the portion of the outer tubular which  
5 has not been expanded.

36. The method as defined in Claim 35, further comprising:  
interconnecting the one or more pistons and the lower expander with an outer sleeve; and  
interconnecting the outer sleeve and the work string with a shear member;  
10 and  
increasing fluid pressure to shear the shear member.

37. The method as defined in Claim 35, further comprising:  
positioning a plug seat within the tool, such that a plug landed on the plug seat causes an increase in fluid pressure in the tool and to the one or more pistons.

15 38. The method as defined in Claim 35, further comprising:  
expanding only a selected portion of the downhole tubular, the expanded portion being positioned below a portion of the downhole tubular which is not expanded.

39. The method as defined in Claim 35, wherein the downhole tubular is expanded along substantially its entire length.